



## **Benefits of interrelationships between climate change mitigation and adaptation – a case study of replanting mangrove forests in Cambodia**

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## Benefits of interrelationships between climate change mitigation and adaptation

– a case study of replanting mangrove forests in Cambodia

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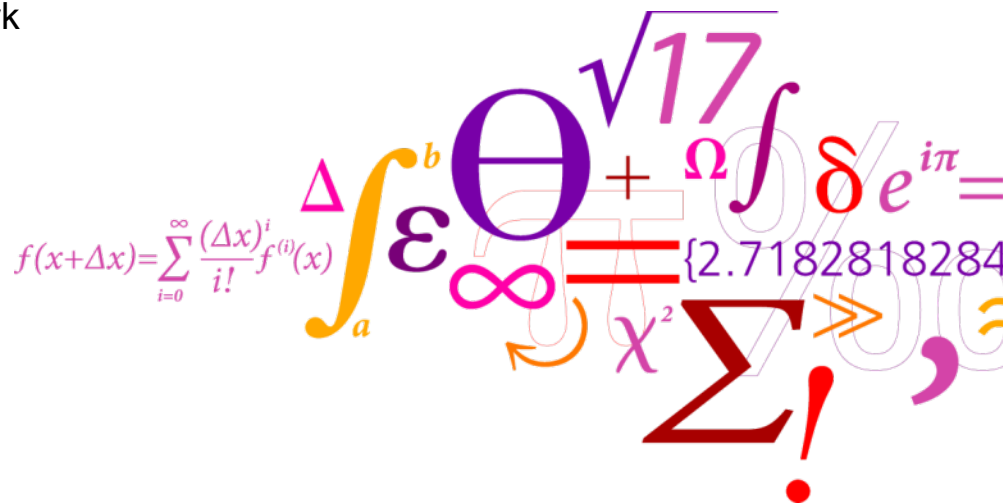
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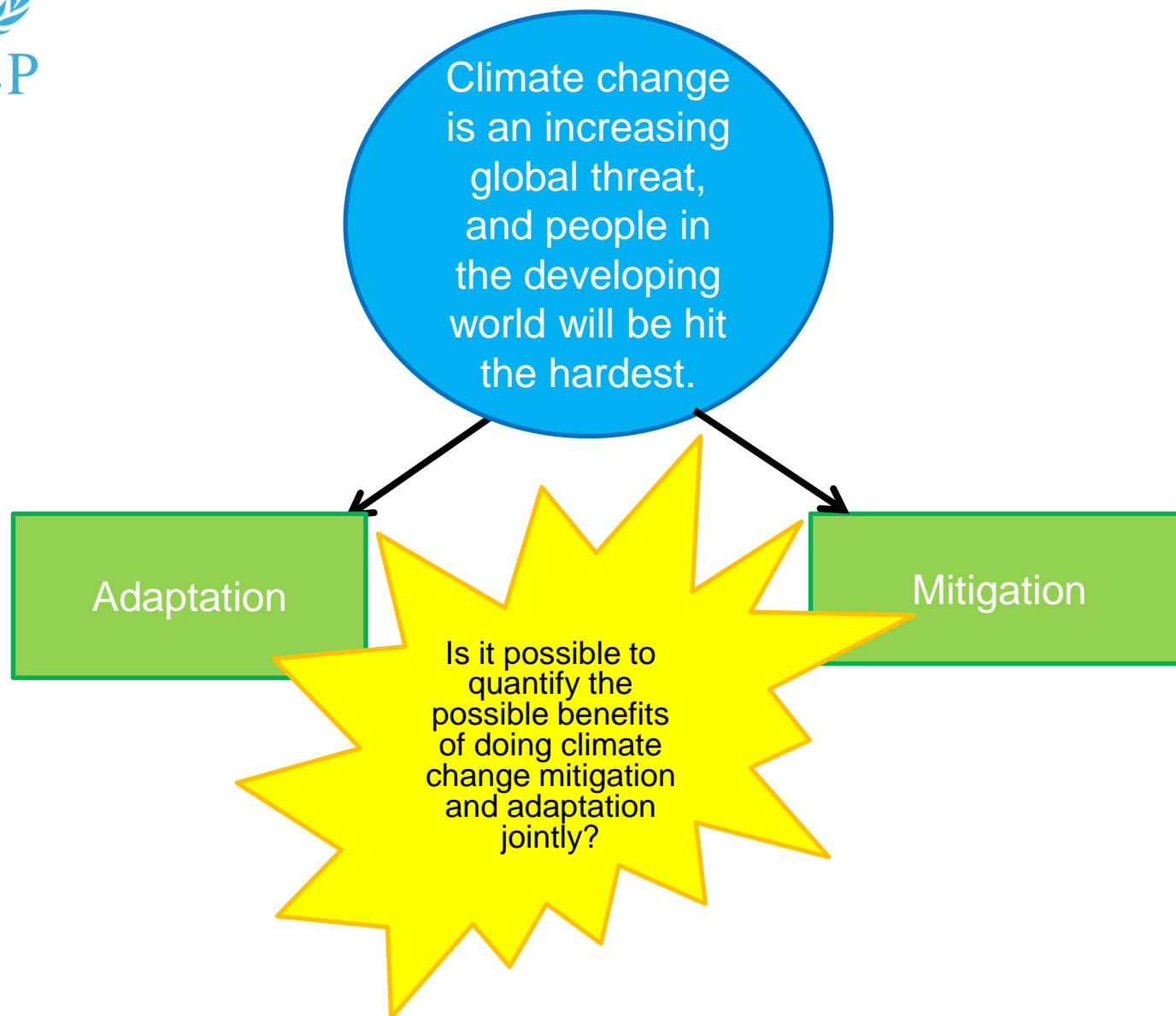
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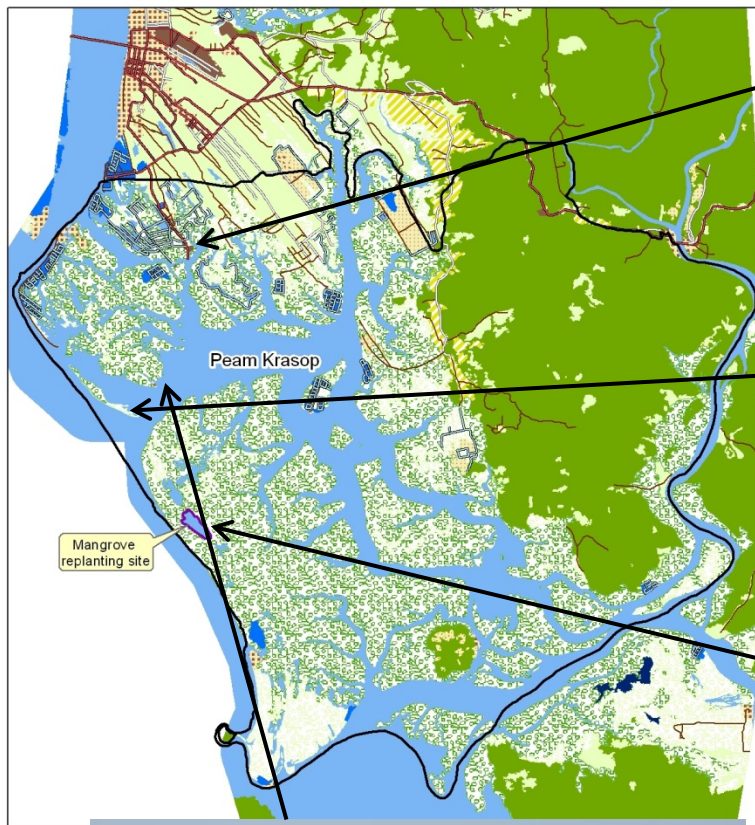


# Outline...

- Local context
  - Case study: Peam Krasaob Commune
  - Climate Changes in Cambodia
- How to measure a possible benefit between CC mitigation and adaptation –Joint production
  - (benefit of CC mitigation)
  - benefit of CC adaptation
    - EDF
      - Storm damage function
      - Damage cost function
- Questions to you....

# Peam Krasaob Wildlife Sanctuary, Cambodia

Proposed Mangrove Replantation in Peam Krasop Wildlife Sanctuary







# Climate change predictions for Cambodia

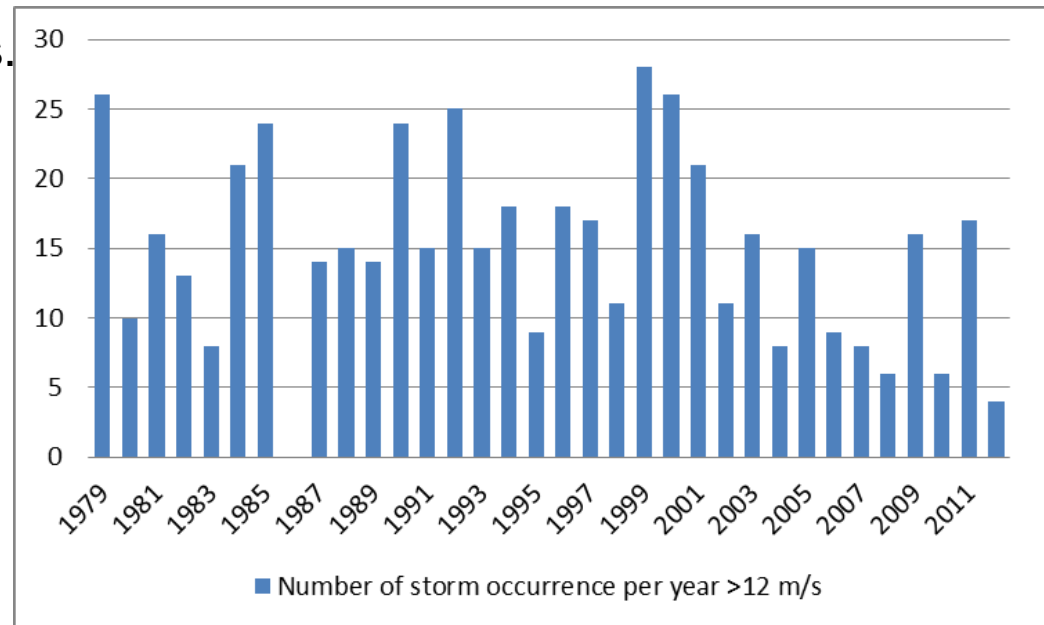
- Increasing number of hot days.
- Increasing precipitation (leading to flooding).
- Drought.



## Threats to Cambodia's coastal zone

- Tropical cyclones, storm surges.
- Rising sea level
- Beach erosion.
- Saltwater intrusion (on farm land).

**2011:** 1,4 hectares of mangrove forest were destroyed do to wind damages. Estimated material damage: 59.400 US\$ (178 US\$ per HH)



# How to measure the possible benefits of climate change mitigation and adaptation, respectively?

**Joint production** (Vincent & Binkley 1993)

- Or multiple-use forestry
- The two products:
  - **CC mitigation:** Carbon sequestration in the replanted mangrove forest (global benefit).
  - **CC adaption:** The mangrove forest's ability to protect the local community from storm damages (local benefit).
- Management efforts need to be allocated between the two products or the size of the stand etc.



# CC adaptation benefits?

- **Expected Damage Function (EDF)**

- (Hanley & Barbier 2009, Barbier 2007)

EDF costs avoided (do to replanting of the mangrove forest (**S**))

- EDF cost

= The **benefit of the adaptation** capacity







**Assumption made** (Barbier 2007, Hanley & Barbier 2009):

- The local community owns all economic activities and properties, and the properties are threaten from damages of storm.
- The households are identical, so one household can represent all households.
- The representative household expenditure function is expressed as  $m(P^x, Z, U^0)$ .

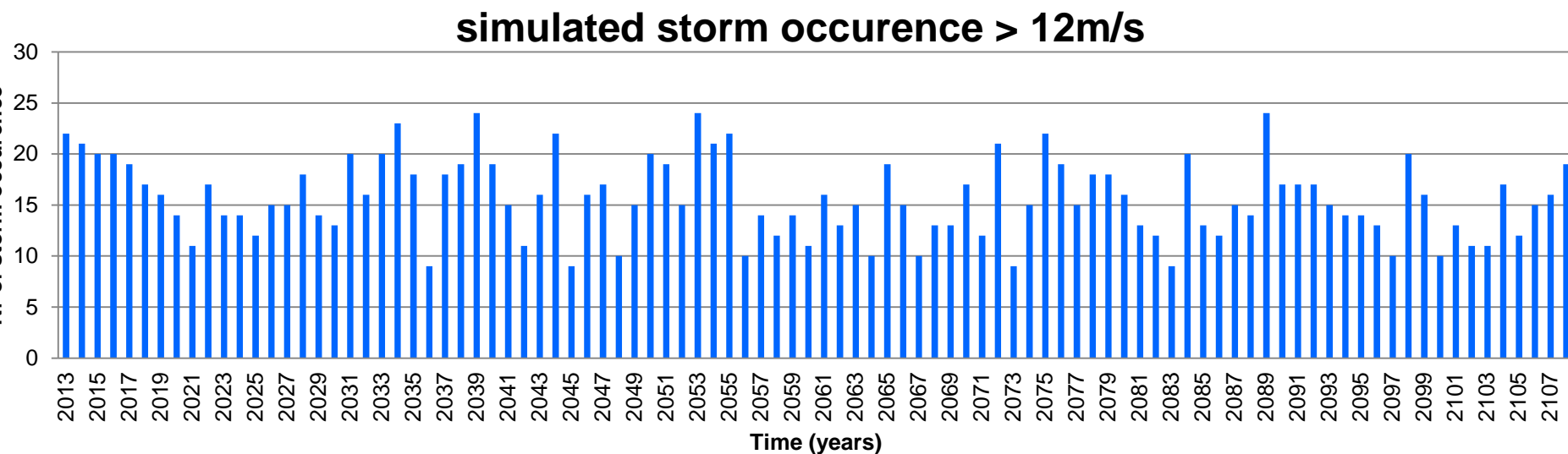
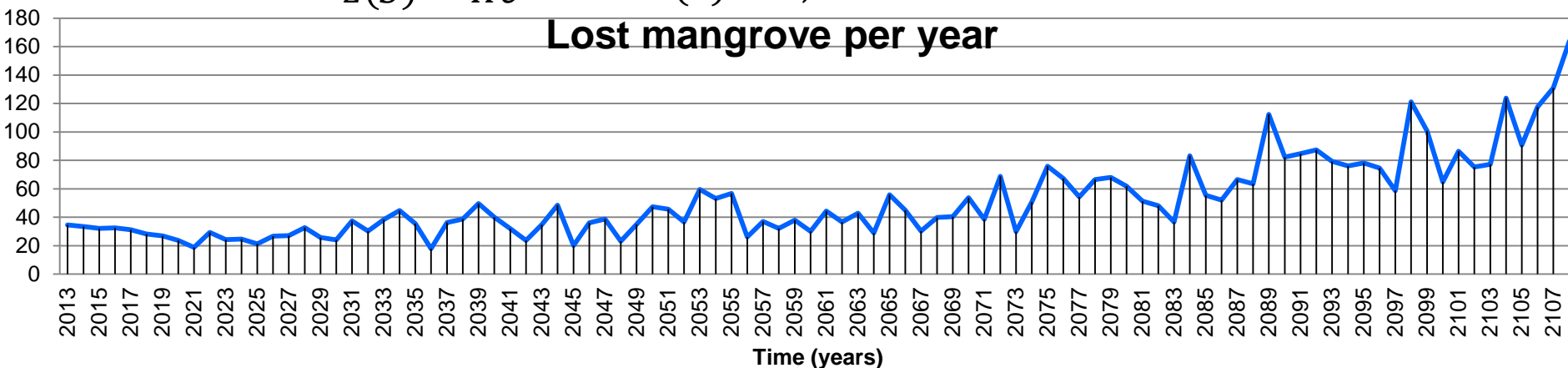
- $P^x$  is the price vector for acquired goods consumed by the household.
- $z$  represents the number of storms and natural hazard occurrences (which can vary).
- $U^0$  is the utility level for the household's minimum spending necessary to reach this utility level.



**Storm damage function** -damages on the mangrove forest caused by natural disasters and storm

-We simulate the storm occurrences over the next 100 years – assuming that the function for damage per storm looks like this:

$$z(S) = Ke^{-aS} \quad z'(S) < 0, z'' > 0$$



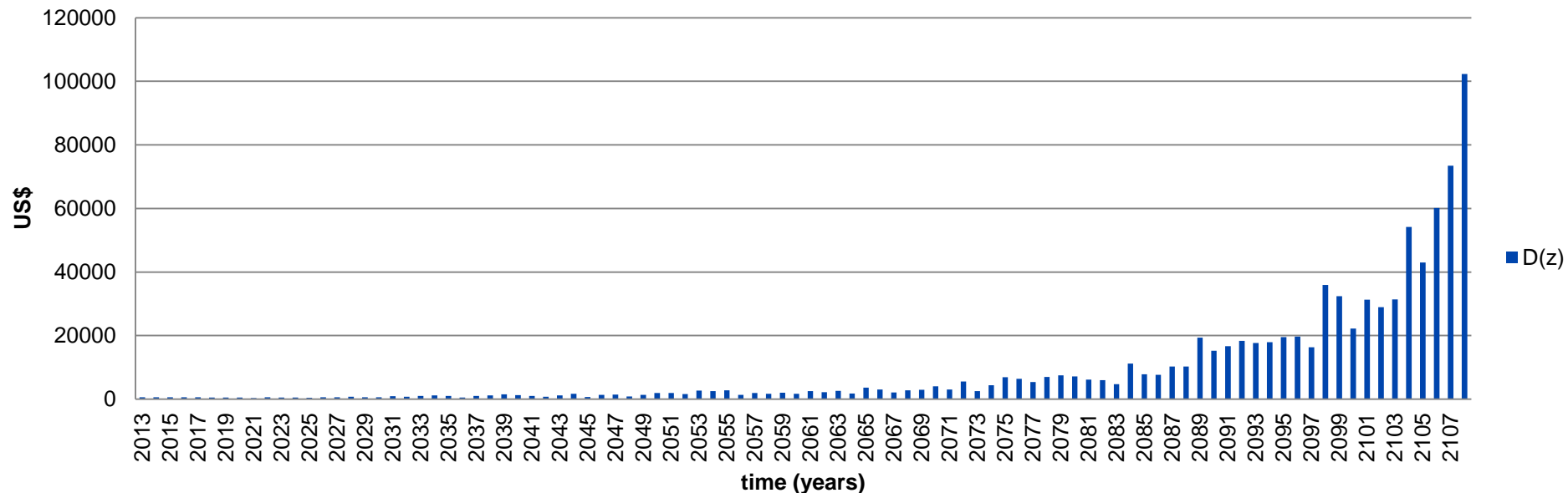
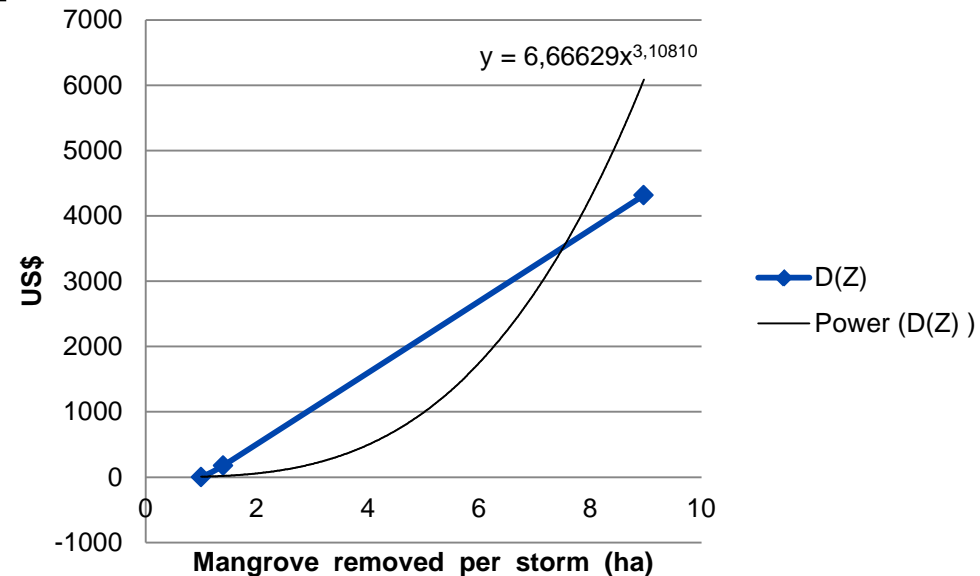
# Damage cost function

- Based on what we know of  $z(S)$  (lost mangrove per storm do to storm and natural hazards), we can plot what we know:

- Estimated damages in 2011 per HH.
- Estimated cost of total destruction of HH.

- Assuming this damage function:

$$D(z) = bz^g$$

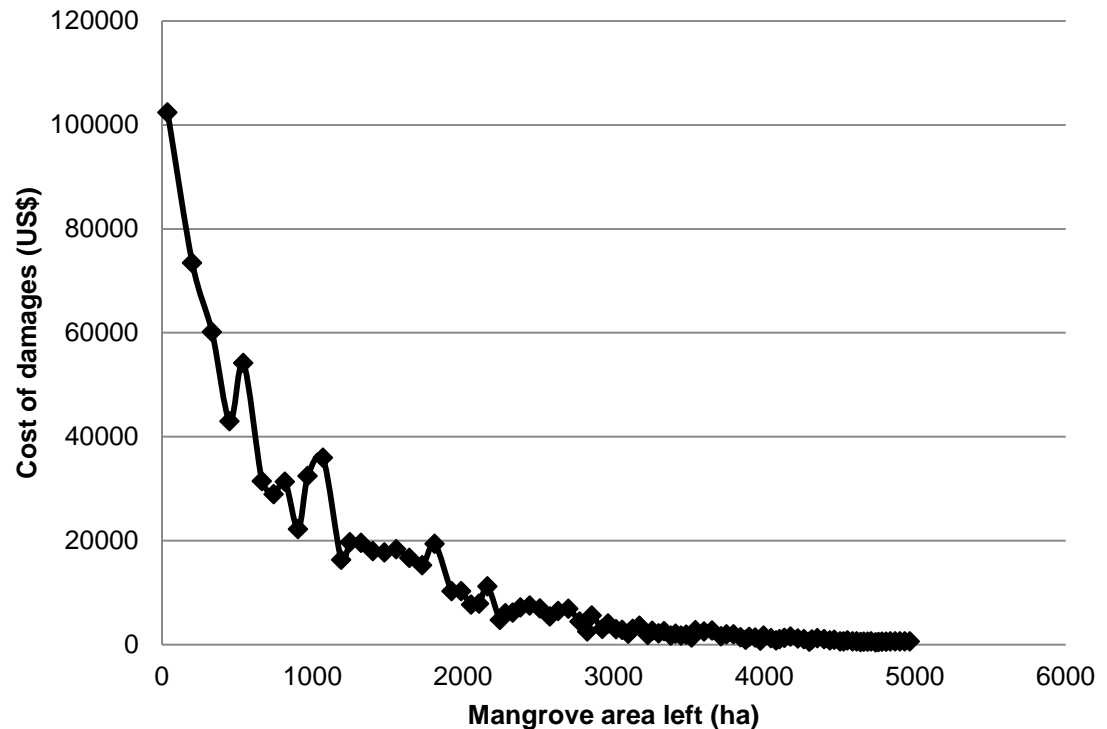


## Expected Damage Function $\sim D(z(S))$

- $D(z(S)) = b(Ke^{-aS})^g$

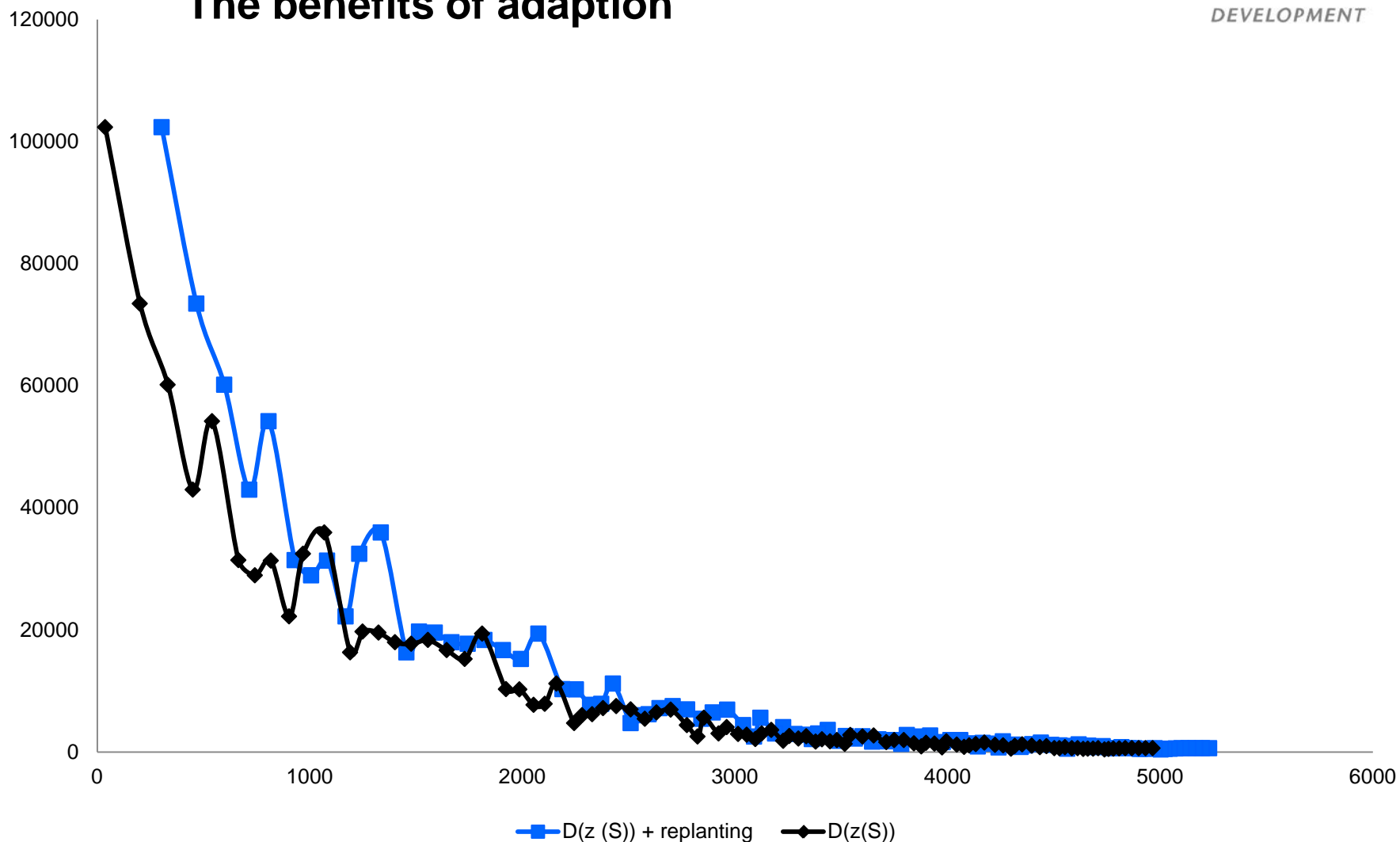
- Knowing the **storm damage function  $z(S)$**  for storm hazards per year and the **damage cost function  $D(z)$**  per year, it is possible to calculate the **expected damage cost** of a change in the mangrove area.

- It is also possible to determine the benefits for the mangrove forest protecting the local community.





**EDF ( cost avoided; when replanting of the mangrove forest) – EDF (costs; when loosing the mangrove forest) =**  
**The benefits of adaption**



# Questions to you....



- What are **the local and global benefit**, respectively, of carbon sequestration in the replanted area?
- Are there other ways to **simulate climate changes' impact** (damage) on the mangrove forest?
- Is it realistic to consider it a **joint production, as no immediate trade-off is found** between mitigation and adaptation (in this case)?
- Is the assumption concerning the **storm damage function** and the **damage cost function** acceptable?





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**Thank you...**



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